

# Mesh Router User's Guide



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# Mesh Router User's Guide

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# Mesh Router User's Guide

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## 1 WARNINGS

### Read Before Operating

This manual must be carefully read by all individuals who have or will have the responsibility of using, maintaining, or servicing this product. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.

### Warning:

Use only the Lithium battery or external rechargeable battery provided by RAE Systems. This instrument has not been tested in an explosive gas/air atmosphere having an oxygen concentration greater than 21%. Substitution of components may impair suitability for intrinsic safety. Replace batteries only in non-hazardous locations.

**STATIC HAZARD:** Clean only with a damp cloth.

For safety reasons this equipment must be operated and serviced by qualified personnel only. Read and understand instruction manual completely before operating or servicing. Any rapid up-scale reading followed by a declining or erratic reading may indicate a gas concentration beyond upper scale limit, which may be hazardous.

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## Marking

The Mesh Router is certified according to the IECEx scheme, ATEX and CSA for US and Canada as protected by intrinsic safety.

The product is marked with the following information:




RAE SYSTEMS

3775 N. 1<sup>st</sup>. St., San Jose

CA 95134, USA

FMC-400

Serial No/barcode: XXX-XXXX-000

IECEx TSA 10.0016X Ex ia IIC T4 Ex ia I	 0575  IM1/II 1G Ex ia IIC T4 Ex ia I DNV 10 ATEX 83388X	 Class I, Gr. A,B,C,D T4 Intrinsically Safe
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$-40^{\circ}\text{C} \leq T_{\text{amb}} \leq 50^{\circ}\text{C}$

## Warnings:

- Use only RAE 500-0111-000 for internal battery. Do not replace internal battery in hazardous locations.
- $U_i$ : 3.6V;  $C_i$ : 78 $\mu$ F;  $Li/R_i$ : 3.5 $\mu$ H/ $\Omega$
- Understand User's Manual before operating or servicing.
- Substitution of components may impair intrinsic safety.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

## Applied Standards

IECEx	ATEX	North America
IEC 60079-0:2004	EN 60079-0:2006	CAN/CSA-C22.2 No. 0-M91
IEC 60079-11:2006	EN 60079-11:2007	CAN/CSA-C22.2 No. 157-92
		C22.2 No. 142-M1987
		UL 913
		UL916

## **1.1 Operation Area and Conditions**

### **1.1.1 Hazardous Areas classified by Zones**

Mesh Router is intended to be used in hazardous areas or mines susceptible to firedamp classified zone 0, zone 1 or zone 2, within the temperature range of -40° C to +50° C, where gases of explosion groups IIA, IIB or IIC and T4 may be present.

### **1.1.2 Hazardous Areas classified by Divisions**

Mesh Router is intended to be used in hazardous areas classified for Class I Div. 1 or 2, within the temperature range of -40° C to +50° C, where gases of explosion groups A, B, C or D and temperature class T4 may be present.

## **1.2 Instruction For Safe Use**

Strictly follow the instructions for safe use. Application of the Mesh Router requires full understanding and strict observation of the instructions.

## **1.3 Use In Hazardous Areas**

Equipment which is intended for use in explosive atmospheres and which has been assessed and certified according to international regulations may be used only under specified conditions. The components may not be modified in any way.

The appropriate regulations for service and repair must be properly observed during such activities.

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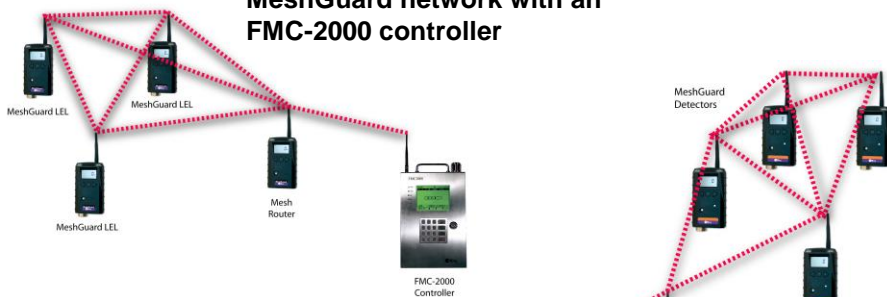
## 2 Standard Kit

Router with antenna  
Maintenance tool  
User's Guide

## 3 General Information

The Mesh Router is a dedicated router for relaying the wireless signals in a Mesh network and does not include a toxic gas sensor. The Mesh Router enables a flexible, robust wireless network that provides reliable, low-cost operation. It also works in a ProRAE Guardian network with a PC, and it supports point-to-point and point-to-multi-point networks.

**MeshGuard network with an FMC-2000 controller**



**MeshGuard network with ProRAE Guardian running on a PC controller**



**Portable monitors in a network with an EchoView Host (Mesh Routers with 869MHz or 900MHz radios only; 2.4GHz is not supported in systems with portable monitors)**





## 2.1 Key Features

- Up to 45 days continuous operation using external battery box
- IEEE 802.15.4 Mesh network functionality with 64-bit encryption
- Mesh network with auto network forming and configuration
- Operating distance: up to 300 m, line of sight
- Very low-cost installation – no hardwiring involved
- Large area coverage with multi-hop mesh network
- Field-replaceable battery
- Loud audio alarm, 90dB @ 30cm (12")
- Easy-to-read continuous display of signal strength
- Bright red flashing alarm
- Highly resistant to RFI interference
- IP-65 rated for outdoor use in harsh environments

## 4 Physical Description



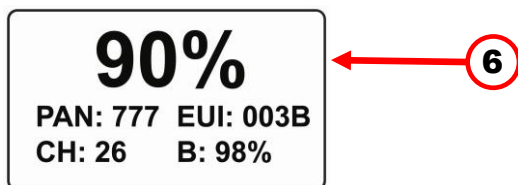
1	LED alarm
2	LCD (with backlighting)
3	Buzzer alarm
4	Battery cover (on bottom)
5	Y/+, MODE, and N/- keys
6	Antenna

### 4.1 LCD Display (Monitoring)



1	Online/Offline status
2	Pan ID
3	Channel
4	EUI (Extended Unique Identifier)
5	Battery strength indicator (percentage)
6	Signal strength indicator (percentage)

When you press [MODE], Online/Offline status is replaced by signal strength:



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## 5 Specifications

<b>RF Certifications</b>	FCC Part15 R&TTE Directive 1995/5/EC
<b>Display</b>	Customized LCD (1 x 1.5") with backlight
<b>Audible alarm</b>	90dB @ 30cm
<b>Visual alarm</b>	2 super-bright red LEDs
<b>Calibration</b>	None necessary
<b>RF</b>	IEEE 802.15.4/Zigbee with mesh stack
<b>EM Immunity</b>	No effect when exposed to 0.43mW/cm <sup>2</sup> RF interference (5-watt transmitter at 12")
<b>Operating Range</b>	Minimum of 300 meters, line of sight
<b>Receiver Sensitivity</b>	Minimum -95dBm
<b>User Interface</b>	Three keys (Y/+, MODE, N/-)
<b>Power Supply</b>	D-size Lithium primary battery, +3.6V
<b>Max Current Consumption</b>	300mA@3.6V during transmission <30mA@3.6V during standby
<b>Operation Time</b>	Internal Battery: >10 days External Battery: >45 days
<b>Operating Temperature</b>	-40° to +50° C (-40° to 122° F)
<b>Humidity</b>	0% to 95% relative humidity, non-condensing
<b>Dimensions</b>	26.5cm x 9.5cm x 5.5cm (10.5" L x 3.7" W x 2.1" H)
<b>Weight</b>	0.6 kg (1.3 lbs)
<b>Package</b>	IP-65
<b>Mounting</b>	Optional stainless-steel bracket mount or magnetic mount; wall mount for external battery

### FCC Part 15 Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 6 Operation

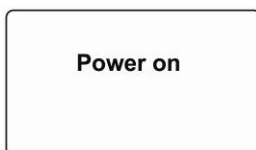
The Mesh Router only operates in RTR mode. Therefore, when it is turned on, it is always operational.

Whenever you start Mesh Router, it tries to rejoin the last network it was part of. Therefore, if the network is within range and if the channel and Pan ID have not changed, the Mesh Router should be able to rejoin the network without action on your part.

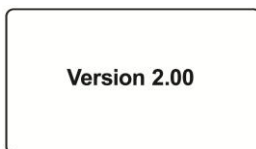
Make sure the battery is installed before operating the Mesh Router. Refer to page 36 for information on battery installation and replacement.

### 6.1 Turning The Mesh Router On

Hold down the [MODE] key and release it when the Mesh Router beeps. The display indicates that it is now on:



The Mesh Router performs a self-test. The display briefly shows the firmware version:



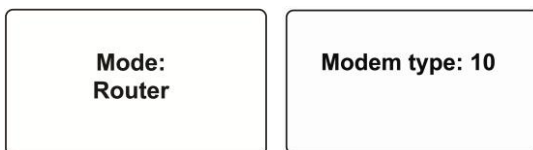
Next, it shows the firmware's build date and time:



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This is followed by the Modem Type:



Then the Mesh Router initializes connection with the wireless network. When the network is found and communication is established, the main reading screen is shown. It includes the Pan ID, EUI (Extended Unique Identifier), channel number, and battery charge (percentage):



If the Mesh Router is unable to find a radio network to connect with, it searches, but if it is unsuccessful, it displays this screen:



If you see this screen, check the following:

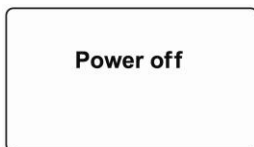
- Is the antenna is attached?
- Does the Pan ID match the network you want to join?
- Does the Channel match the channel on which the other instruments are operating?
- Are the other instruments turned on and within range?
- Did you change the Pan ID or Channel? If so, restart the instrument.

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### 6.2 Turning The Mesh Router Off

Hold down the [MODE] key through the “5...4...3... 2... 1... Power Off” sequence. When you see “Power off,” release the [MODE] key.



The Mesh Router is off when the display is blank.

### 6.3 Battery Charge Indicator

The Mesh Router's internal battery is designed to provide power for up to 10 days. When the battery gets low, the Mesh Router beeps once per minute and the battery icon is empty. It is recommended that the battery be changed immediately, to minimize disruption.

Battery power is indicated by “B:” followed by a number and a percent sign. For example, B: 100%. The battery should be replaced before it is completely discharged. See page 36 for the replacement procedure.

When the battery is completely depleted, the LCD displays “Power off.” and the LED and buzzer alarm activate once per second. The Mesh Router shuts down after you press any key, or shuts down automatically if you do not press a key for 60 seconds.

**Note:** An external power source, the RAE PowerPak, can be used as a substitute for the internal battery. See page 46 for installation details.

## 7 Button Functions

The three buttons provide fast access to functions in the Mesh Router.

- Press [MODE] to view signal strength.
- Press [Y/+] to initialize connection with the network.
- Press [N/-] to ping the network.

### 7.1 Backlight

Whenever you press the [Y/+] , [MODE], or [N/-] key while viewing the data, the backlight turns on for two seconds and then shuts off.



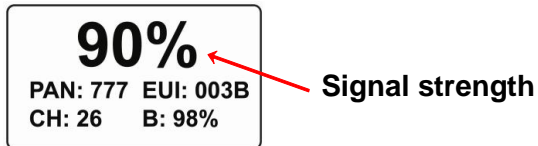
## 8 Deploying Mesh Routers

**Important!** Before deploying a Mesh Router, it is important to have the Pan ID and Channel number on which the rest of the network is operating. Without these numbers programmed into your Router, you cannot make it communicate with the network.

### 8.1 With FMC 2000 Controller

When deploying a MeshGuard network that utilizes Mesh Routers, follow this setup order:

1. Turn on the FMC2000 Controller.
2. Turn on a Mesh Router and use it to measure signal strength at each prospective detection location. Press [MODE] on the Mesh Router to see the signal strength:



- a. If the signal strength reading on the Mesh Router is 30% or greater, then that indicates a MeshGuard or MeshGuard LEL will communicate reliably from this location with the FMC2000 controller. Locate and turn on a MeshGuard or MeshGuard LEL detector here.
- b. If readings are below 30%, relocate the Mesh Router until the reading is 30% or higher. If this new location is unacceptably far from the desired detection location, an additional Mesh Router or MeshGuard in RTR mode is needed to relay the signal from this new location.

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3. Follow this procedure until all MeshGuard or MeshGuard LEL detectors in the network are deployed. Check communication reliability for all detectors and routers at the FMC2000.

### **8.2 With Portable Monitors**

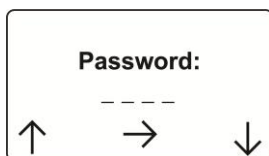
When deploying a wireless network that utilizes Mesh Routers, portable monitors (such as the ToxiRAE Pro, MultiRAE family, etc.), and an EchoView Host, check that all units on the network use the same PAN ID and Channel. Then follow this setup order:

1. Turn on the Mesh Routers.
2. Turn on the EchoView Host.
3. Turn on the monitors.
4. If any of the units do not automatically join the network, check their network settings and perform a Join Network.

## 9 Programming The Mesh Router

Programming Mode is accessed by first providing the correct password.

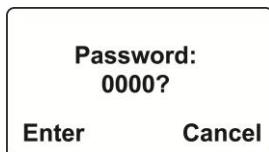
Press and hold [MODE] and [Y/+] until you see this screen:



Input the 4-digit password:

- Increase the number from 0 through 9 by pressing [Y/+].
- Decrease the number from 9 through 0 by pressing [N/-].
- Step from digit to digit using [MODE].

Once all the four digits have been entered, press [MODE] again to see the following screen appear. Press [Y/+] to enter the password.



If you make a mistake, you can cycle through the digits by pressing [MODE] and then using [Y/+] and [N/-] to change the number in each position.

**Note:** The default password is 0000.

If your password is incorrect, you see this screen:

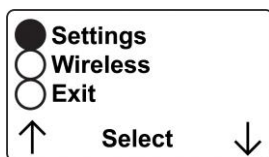


After a few seconds, the Mesh Router exits to its main screen.

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When you have successfully entered Programming Mode, you see this screen:



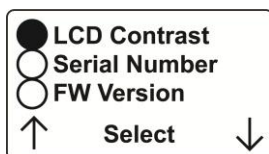
**Note:** If you do not make a selection in 60 seconds, the Mesh Router automatically exits to the main screen.

Press [Y/+] or [N/-] to scroll to “Settings,” “Wireless,” or “Exit.” Then press [MODE] to select your choice.

**Settings** provides information about your instrument. Some screens are read-only (you cannot edit them), but other screens allow you to change settings.

**Wireless** consists of parameters you can set/change that affect wireless functionality, network configuration, etc.

Settings include some read-only information (Serial Number and Firmware Version) and some settings that you can change.



Press [Y/+] to scroll up or [N/-] to scroll down.

**Note:** The next screen contains additional options:



**Note:** The scrolling “wraps,” so once you reach the first or last item, it starts scrolling through the items again.

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Six choices (including Exit) are available:

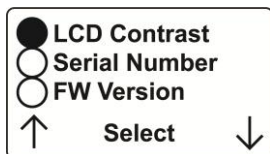
- LCD Contrast
- Serial Number (read-only)
- Firmware Version (read-only)
- Factory Reset
- Edit Password
- Exit

To make a selection, scroll until the circle to the left of your choice is black, and then press [MODE].

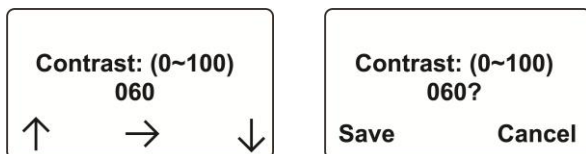
**Note:** If you do not make a selection in 60 seconds, it automatically exits to the main screen.

## 9.1.1 LCD Contrast

The display's contrast is adjustable via this menu. To access it, press [MODE] when its name is highlighted (dark circle):



The contrast value is shown in the display. Step through the digits from left to right by pressing [MODE]. Change a digit's value by pressing [Y/+] to increase and [N/-] to decrease. After the third digit, you see a flashing “?”



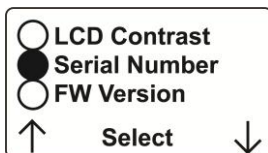
- Save your changes by pressing [Y/+].
- Exit without saving changes by pressing [N/-].
- Step back to the first digit by pressing [MODE].

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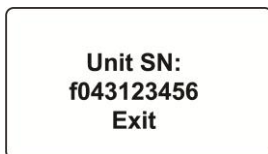
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## 9.1.2 Serial Number

This shows the Serial Number of the Mesh Router. To view it, press [MODE] when “Serial Number” is highlighted (dark circle):



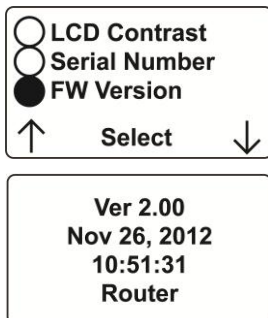
The serial number is shown in the display:



Press [MODE] to return to the Settings menu. If you do not make a selection in 60 seconds, the unit automatically exits to the menu.

## 9.1.3 Firmware Version

This shows the firmware version incorporated in the instrument. It is read-only. You cannot make changes to the information. To view it, press [MODE] when its name is highlighted (dark circle):



Press [MODE] to return to the Settings menu. If you do not make a selection in 60 seconds, it automatically exits to the menu.

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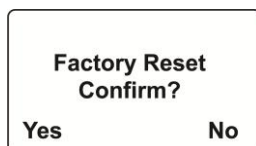
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## 9.1.4 Factory Reset

You can perform a factory reset to the instrument's original settings. To access it, press [MODE] when its name is highlighted (dark circle):



You are asked whether you want to perform the factory reset:



To perform the reset, press [Y/+]. To exit without performing the reset, press [N/-].

While the Mesh Router is being reset to its original factory settings, the screen shows that the activity is taking place:



When the reset is complete, this screen appears:



Then the unit returns to the Settings menu.

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**Note:** If you perform a factory reset, all of your settings are removed and cannot be retrieved.

### 9.1.5 Edit Password

You can change the password by selecting “Edit Password.”



At this screen, input your new password over the old one (or the default):

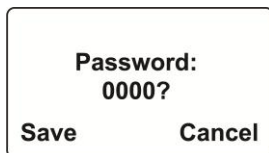
- Increase the number from 0 through 9 by pressing [Y/+].
- Decrease the number from 9 through 0 by pressing [N/-].
- Step from digit to digit using [MODE].

**Note:** If you make a mistake, you can cycle through the digits by pressing [MODE] and then using [Y/+] and [N/-] to change the number in each position.



Once all the four digits have been entered, press [MODE] again to see the following screen appear.

- Save your changes by pressing [Y/+].
- Exit without saving changes by pressing [N/-].
- Step back to the first digit by pressing [MODE].

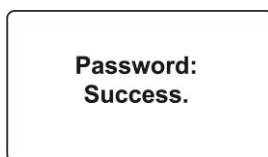




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Saving the password takes a moment, and a screen indicates that it has been successfully saved:



## 9.1.6 Exit

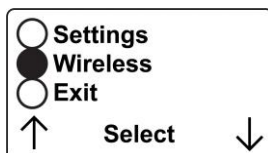
Scroll until “Exit” is selected.

Press [MODE] to return to the Programming Menu.

**Note:** If you do not make a selection in 60 seconds, it automatically exits to the menu.

## 9.2 Wireless

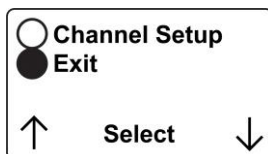
Wireless consists of editable parameters and actions to configure, form, and test a closed-loop wireless network.



Under Programming Menu, select “Wireless.”

Press [Y/+] to scroll up or [N/-] to scroll down through wireless sub-menus.

**Note:** When you reach the last item and continue scrolling, a second screen appears:



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The scrolling “wraps,” so once you reach the first or last item of either screen, it starts scrolling through the items in the other screen again.

Five choices (including Exit) are available:

- Ping Net
- PANID Setup
- Join Net
- Channel Setup
- Exit

To make a selection, scroll until the circle to the left of your choice is black, and then press [MODE].

**Note:** If you do not make a selection in 60 seconds, it automatically exits to the main Programming Menu.

## 9.2.1 Ping Net

Pinging tests the radio connection between the Mesh Router and other units on its network. (A “ping” is a short signal sent to the network to prompt a reply; it contains no other data.)

Scroll until “Ping Net” is selected.



Press [MODE] to ping the network. This message appears:



Press [Y/+]. The Mesh Router broadcasts a ping signal to its network. All devices in the network that receive the ping signal respond with a beep if

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they are within the range. You can also ping from an instrument in the network. If it is within range, the Mesh Router responds with a beep and an LED light flash.

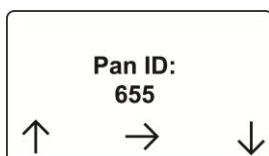
If a network ping is unsuccessful, check the following:

- Is the antenna attached?
- Does the PAN ID match the PAN ID of other instruments in the network?
- Does the Channel match the channel on which the other instruments are operating?
- Are the other instruments turned on and within range?

### 9.2.2 PAN ID Setup

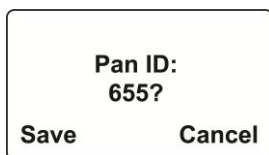
All units on a network must be programmed with the same PAN ID (Personal Network Identifier) to ensure communication compatibility.

When you see this screen, press [MODE] to view the current PAN ID or to change it:



**Important!** The allowed range for PAN ID numbers is 001 through 999.

The screen shows the PAN ID, with the cursor blinking on the first digit. Step through the digits from left to right by pressing [MODE]. Change a digit's value by pressing [Y/+] to increase and [N/-] to decrease. After the third digit, you see a flashing “?”



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- Save your changes by pressing [Y/+].
- Exit without saving changes by pressing [N/-].
- Step back to the first digit by pressing [MODE].

**Note:** If you do not press a key within 60 seconds, the screen reverts to the programming Menu screen showing Settings, Modem, and Exit.

### 9.2.3 Join Net

This screen is for joining an existing network. When you see this screen, press [MODE] to join a network. This function allows the radio to scan all available channels and choose the least-congested one:

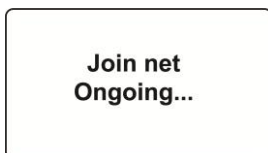


The screen now displays a message asking if you want to confirm your choice to join a network:



- Press [Y/+] to join a network and automatically find the best channel to operate on.
- Press [N/-] to exit without joining a network.

While the instrument starts joining a network, this message appears:



## Mesh Router User's Guide

Once the device has selected the least-congested channel and a network is joined, this message is displayed:



### 9.2.4 Channel Setup

All units in a network must operate on a single channel. The available channels vary by the internal wireless modem's frequency, and channel ranges are set by RAE Systems to correspond with the wireless modem frequency.

These are the modem frequencies and channel ranges:

**869 MHz (for use with portable monitors and EchoView Host):**

Channel 0 (channel cannot be changed)

**900 MHz (for use with portable monitors and EchoView Host):**

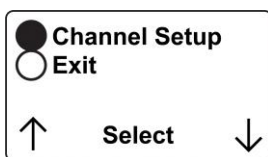
Channels 1 through 10

**2.4GHz (for use with MeshGuard detectors):**

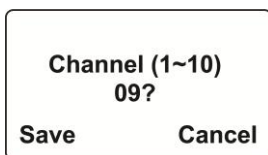
Channels 11 through 26

**Note:** You can use "Form Net" to automatically have the Mesh Router select the least-congested channel.

Scroll until "Channel Setup" is selected.



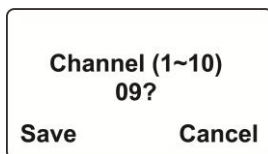
Press [MODE] to view or change the channel. The range of available channels is shown in parentheses. The screen also shows the channel number, with the cursor blinking on the first digit:



## Mesh Router User's Guide

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Step from digit to digit from left to right by pressing [MODE]. Change a digit's value by pressing [Y/+] to increase and [N/-] to decrease. When you press [MODE] you see a flashing “?” after the second digit:

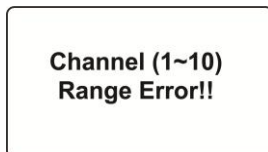


- Save your changes by pressing [Y/+].
- Exit without saving changes by pressing [N/-].
- Step back to the first digit by pressing [MODE].

If you have saved the channel number successfully, you see this screen:



**Important!** Remember that the range of allowed channels for instruments on a Mesh Router's network depends on the wireless modem frequency. Therefore, you may not be able to change the channel to a number outside of its assigned set of numbers. If you select an incompatible channel number, you will see this screen, and then the Mesh Router returns to the Wireless menu.

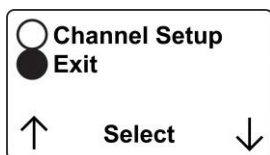


## Mesh Router User's Guide

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### 9.2.5 Exit

To exit Wireless and return to the main Programming Menu, scroll until “Exit” is shown:



With “Exit” selected, press [MODE]. The Mesh Router now returns to the Programming Menu screen.

## 10 “Panic” Function

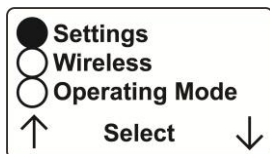
The Mesh Router has a “Panic” function, where you can manually trigger the relays at the main FMC2000 controller in the network. This must be configured in the Mesh Router in advance. This function allows you to trigger any individual relay or all relays simultaneously.

### 10.1 Enabling/Disabling The “Panic Button” Function

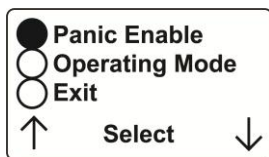
**Note:** By default the “Panic Button” function is disabled.

1. Start the Mesh Router in Diagnostic mode by pressing and holding the [Y/+] and [MODE] keys simultaneously.
2. Once startup is completed and the main screen is shown, enter Programming mode by pressing and holding [MODE] and [N/-] simultaneously.
3. Provide the 4-digit password and press [Y/+] to enter it.  
Note: The default password is “0000.”

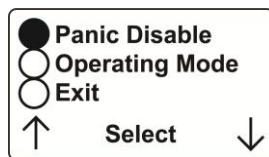
This screen appears:



4. Press [N/-] until “Operating Mode” is highlighted.
5. Press [MODE] to select “Operating Mode.”  
“Panic Enable” or Panic Disable is highlighted.



or

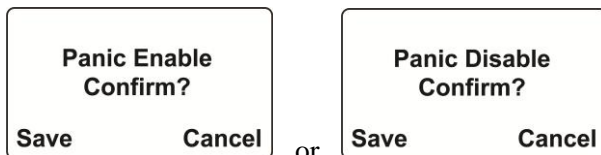




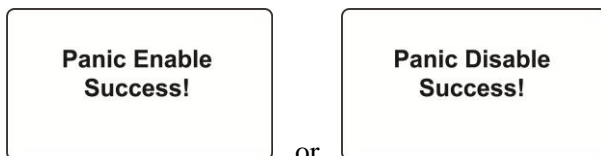
## Mesh Router User's Guide

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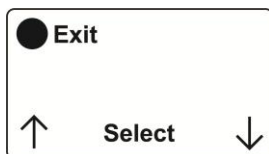
6. Press [MODE] to make your selection.  
You are asked to confirm your selection.



7. Press [Y/+] to save it or [N/-] to cancel any change.  
The change is registered, and you see the "success" screen:



After a few seconds, it returns to the menu screen with "Operating Mode" selected. Press [N/-] to advance to the screen with "Exit" highlighted.



8. Press [MODE] to exit to the main operating screen.



# Mesh Router User's Guide

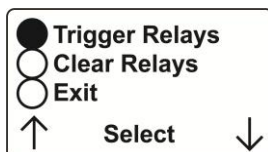
## 10.2 Using The “Panic” Function

The “Panic” function is designed so that it is very difficult to invoke by accident.

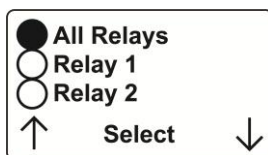
Start from the normal operating mode screen:



1. From the normal operating mode screen, press and hold all three buttons until you see this screen:



2. Now press “Trigger Relays.” This screen is now shown:



### 10.2.1 Trigger All Relays

With “All Relays” highlighted, press [MODE] to trigger all relays simultaneously.

### 10.2.2 Trigger A Selected Relay

Scroll down the list of relays (1 through 5) by pressing [N/-]. Once you have highlighted the individual relay you want to trigger, press [MODE]. This triggers only that one selected relay.

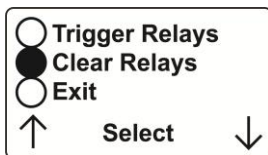
## Mesh Router User's Guide

**Note:** The relay on the FMC2000 controller remains triggered until it is cleared, either at the FMC2000 or at the Mesh Router. Also, the word “ONLINE” on the Mesh Router flashes on and off until you clear the relays.

### 10.2.3 Clear Relays

Clear relays clears all of the relays on the controller, even if only one relay was triggered.

Select “Clear Relays” and then press [MODE] to clear the relays.



After clearing the relays, you can exit by using [N/-] to scroll down to “Exit.” Then press [MODE].

The main screen is shown:



When the relays are cleared, the word “ONLINE” no longer flashes on and off, and returns to its normal state.

### 11 Internal Battery Replacement

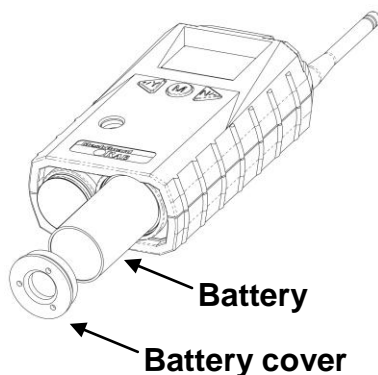


1. Use the 3-pin end of the tool to unscrew and open the battery cover by turning it counterclockwise.
2. Remove the battery.
3. Insert the new battery with its positive (“+”) pole towards inside of the unit.
4. Replace the battery cover by turning it clockwise with the 3-pin end of the tool.

# Mesh Router User's Guide

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**Note:** Only Change battery in a safe location and use the battery RAE Systems provided. After changing the battery, wait at least 60 seconds before turning the Mesh Router on.



## Warning

Only change internal battery in non-hazardous locations and use the battery RAE Systems provides (P/N: 500-0111-000), EVE ER34615 or XENO XL-205F). Only remove the external battery adapter in non-hazardous locations.

## 11.1 Proper Battery Disposal



The Waste Electrical and Electronic Equipment (WEEE) directive (2002/96/EC) is intended to promote recycling of electrical and electronic equipment and their components at end of life. This symbol (crossed-out wheeled bin) indicates separate collection of waste electrical and electronic equipment in the EU countries. This product may contain one or more Nickel-metal hydride (NiMH), Lithium-ion, or Alkaline batteries. Specific battery information is given in this user guide. Batteries must be recycled or disposed of properly.

At the end of its life, this product must undergo separate collection and recycling from general or household waste. Please use the return and collection system available in your country for the disposal of this product.

# Mesh Router User's Guide

## 12 Troubleshooting

Failure Symptom	Cause	Solution
Cannot turn on	Battery charge too low	Replace battery
	Battery has been changed	Wait at least 60 seconds to turn on Mesh Router
	New battery needs to be discharged before use	Check RAE Systems web site for information on batteries
Controller cannot receive the Mesh Router's signal	Too much distance between the Mesh Router and the controller	The distance should be 300 m, line of sight. Relocate Mesh Router(s)
	There is an obstruction between the Mesh Router and the controller. Controller does not receive completed data packet	Relocate the Mesh Router or deploy more Mesh Routers Press [Y/+] on the detector to force it to send data packets
	Battery is low	Replace battery
	Mesh Router and controller have different Pan ID numbers	Set all units to the same Pan ID number
No Antenna Icon	There is no reader or controller nearby.	Move the Mesh Router closer to a working controller or reader.
	The controller or reader's network has changed.	Make sure the selected networks match. Move the Mesh Router

## Mesh Router User's Guide

	The Mesh Router is out of its RF range.  Battery is low	close to a working controller or reader and Press [Y/+]  Replace battery
Others		Turn Mesh Router off and on again.  Consult RAE Systems Customer Service.

**Ordering Replacement Parts:** If you need replacement parts, a list is available online: <http://www.raesystems.com>

### 13 Mesh Router Alarm Signal Summary

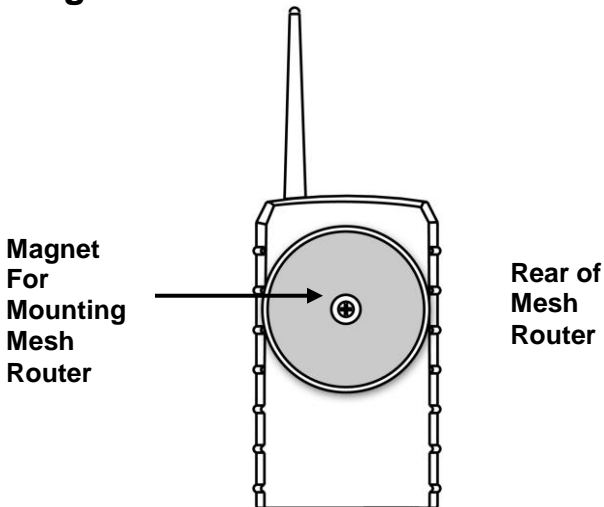
Alarm Mode	When	LCD	Buzzer & LED
Battery Low	< 3.2V	("empty" battery icon)	1 beep per minute
Battery Exhausted	< 3.1V	<div>Power off</div>	1 beep per second



### 14 Appendix A: Mesh Router Installation

Two methods for mounting Mesh Router make it easy to install. The first method uses a magnet that screw onto the rear of the Mesh Router, making ideal for moving from one location to another. The second method uses a specially designed stainless-steel enclosure that is permanently mounted. It protects the Mesh Router from damage in industrial settings.

#### 14.1 Magnet-Mount Installation



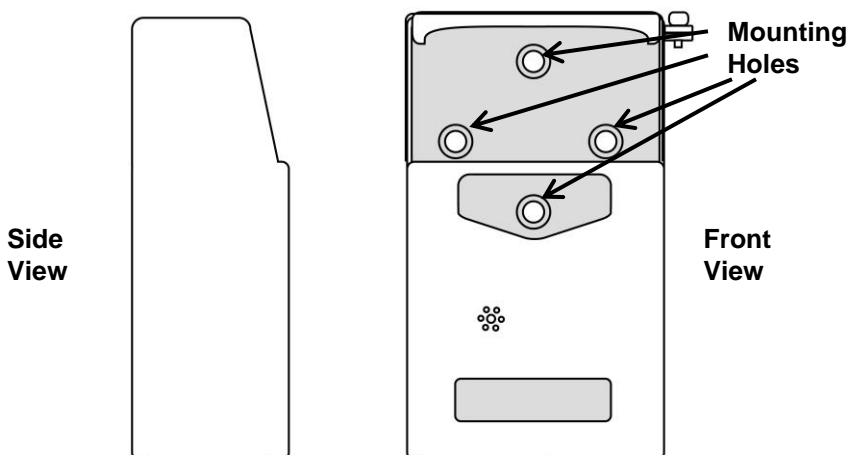
This magnet is powerful enough to support the Mesh Router when it is placed against a flat steel or iron surface.

**Important!** Keep the magnet away from computer hard drives. The strong magnet can corrupt or erase data on these.

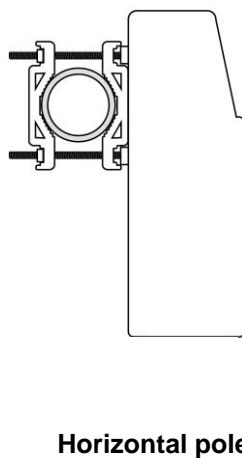
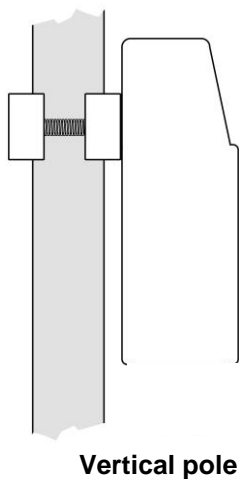
# Mesh Router User's Guide

## 14.2 Fixed Installation

Four reinforced holes in the rear of the enclosure allow for a screw to pass through to the mounting brackets.



The enclosure can be mounted to a vertical or horizontal pole.

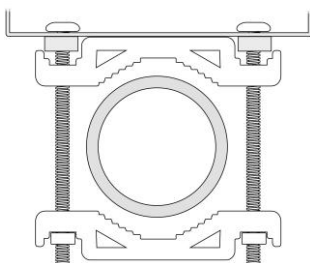


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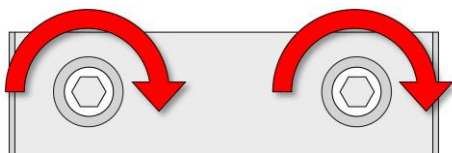
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Slip the screws through the two holes that are side by side in order to mount the enclosure to a vertical pole. Otherwise slip the screws through the two vertically aligned holes to attach the enclosure to a horizontal pole.

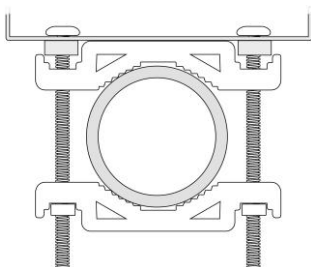
Loosely assemble the clamp parts around the pole. Note that the screws have nuts that fit into the clamp parts. The clamp parts are designed to hold the nut so that you do not need to use a wrench. Hand-tighten the parts until snug.



Tighten the hex screws from the front of the enclosure:



Once the clamp parts and the enclosure are securely held against the pole, stop tightening.

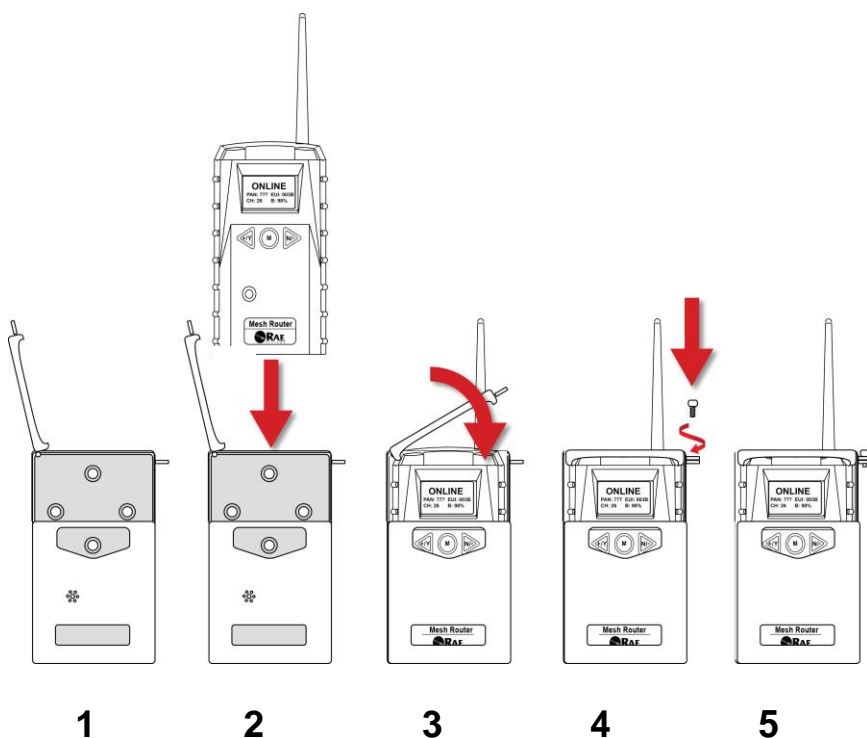


**Note:** The pole must be between 25mm (1") and 63mm (2.5") in diameter.

# Mesh Router User's Guide

Next, place the Mesh Router into the enclosure:

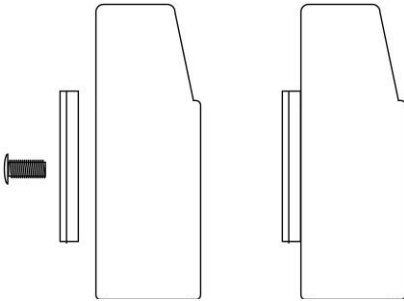
1. Lift up the hinged cover of the enclosure.
2. Slide the Mesh Router into the enclosure from the top.
3. Close the cover of the enclosure.
4. Insert the hex screw into the cover's locking portion, and tighten it.
5. The Mesh Router is now ready to use.



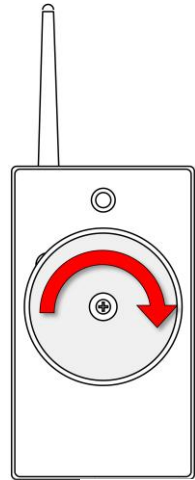
## 14.3 Magnetic Mount Alternative Installation

The magnet-mount disc can be attached to the steel enclosure instead of the clamps. This approach provides the protection of the enclosure with the ease of installation afforded by the magnetic mounting.

1. Insert screw through magnetic disc.
2. Place the magnetic disc over the bottom hole on the rear of the enclosure.
3. Tighten the screw until the disc is snug.



**Side  
View**

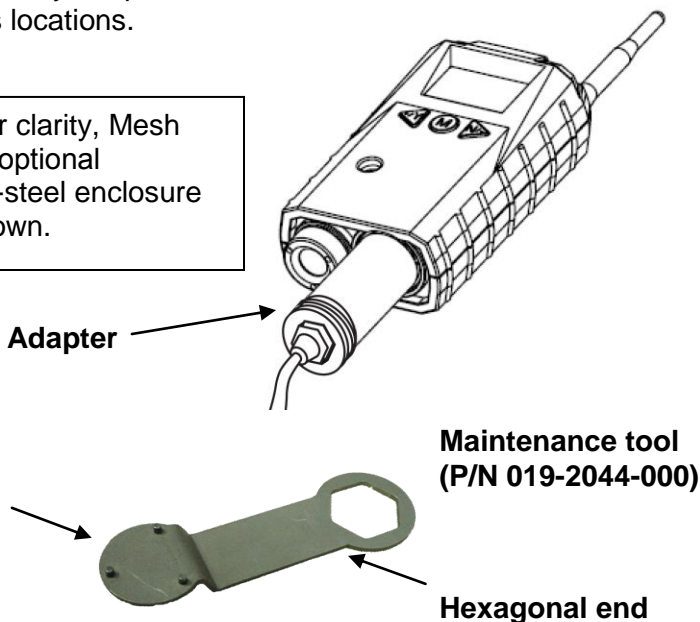


**Rear  
View**

## 15 Appendix B: Mesh Router External Battery Replacement

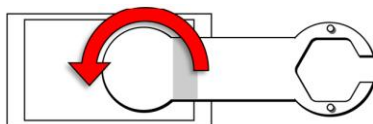
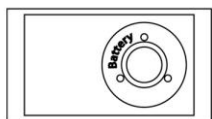
**Warning:** Only remove the external battery adapter in non-hazardous locations.

**Note:** For clarity, Mesh Router's optional stainless-steel enclosure is not shown.



### 15.1 External Battery Usage

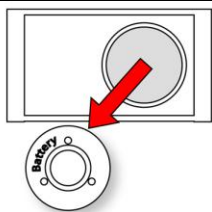
An external battery unit, the RAE Systems RAE PowerPak, is used to power a Mesh Router in fixed installations or in situations where extended battery life is necessary. The connector from the external battery screws into the Mesh Router's battery compartment. Bottom views of the Mesh Router in its steel enclosure are shown in the procedure below.



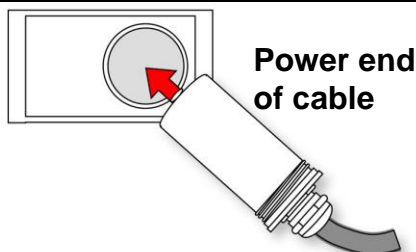
**1. Remove battery cover with the 3-pin end of the sensor and battery removal tool by turning counterclockwise.**

## Mesh Router User's Guide

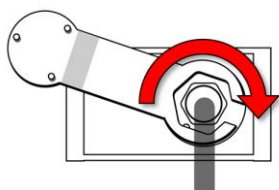
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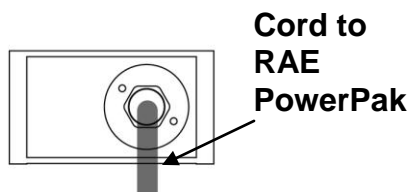
**2. Lift off the cover.**



**3. Insert the power end of the cable connected to the Power Pak.**



**4. Use the open hex end of the wrench, and with both pins mated with the two holes on the power end, tighten by turning clockwise until it is snug. Do not overtighten.**

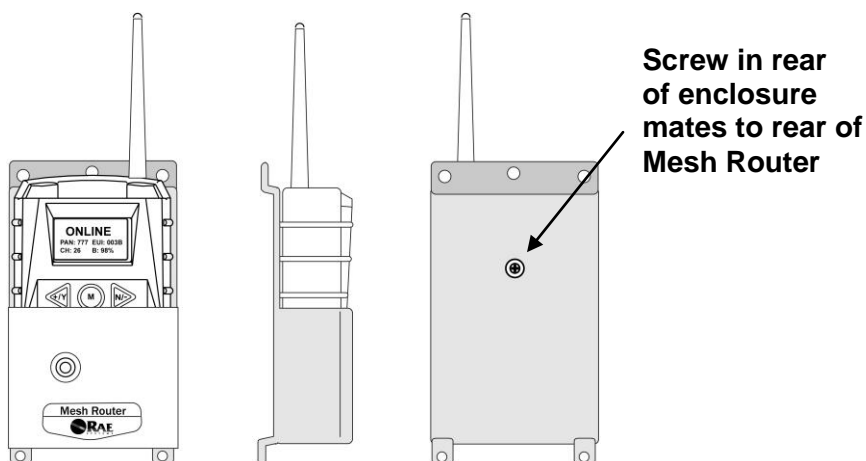


Consult the RAE PowerPak User's Guide for further connection and charging information.

The Mesh Router is permanently mounted to a solid surface by first securing it in its steel enclosure (a screw through the back mates with the Mesh Router) and then securing the enclosure to a solid surface such as a wall or the metal mounting plate that holds both the Mesh Router and the RAE PowerPak.

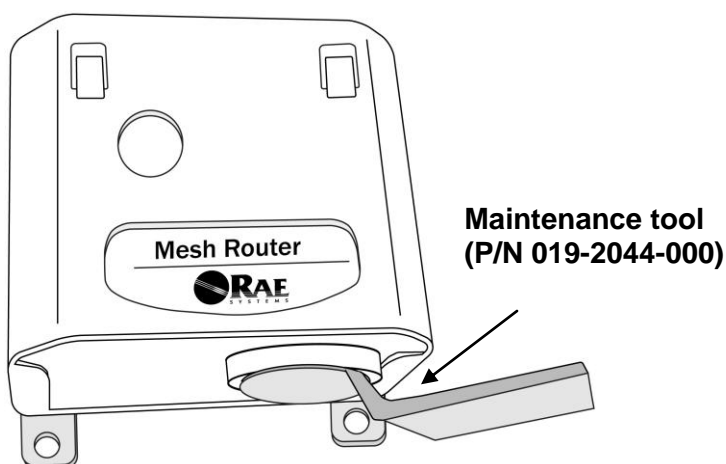
## Mesh Router User's Guide

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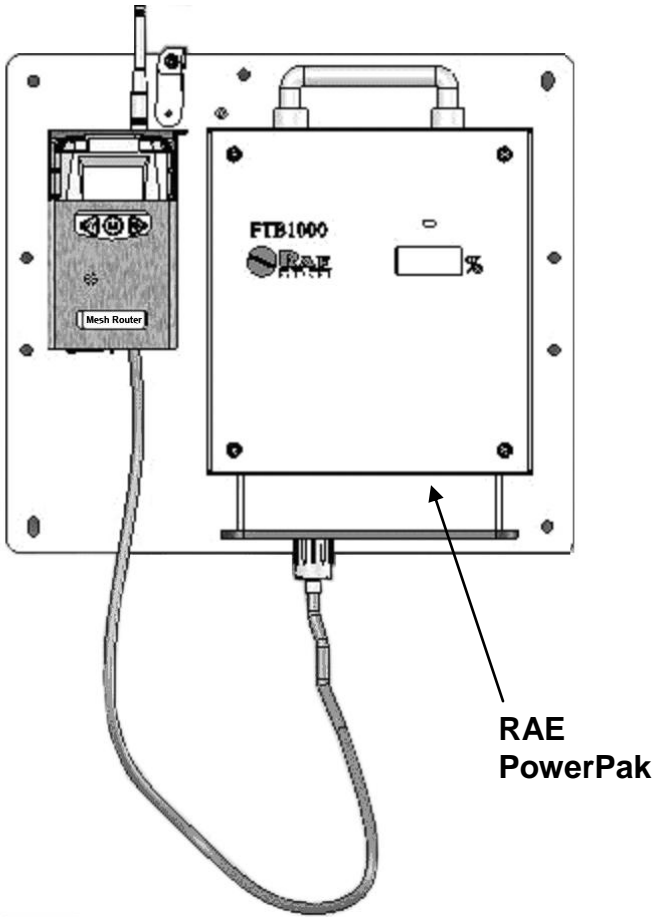
**Front, side, and rear views of the steel enclosure show how the Mesh Router is secured for mounting.**

With the Mesh Router securely in its housing, you can remove the cover over the battery compartment so that you can place the connector from the RAE PowerPak into the Mesh Router. Use the maintenance tool as shown.





### 15.2 External Battery Replacement Process



#### External battery replacement

1. Unplug the battery connector.
2. Loosen the safety screw holding the battery.
3. Mount a new battery on the mounting bracket.
4. Tighten the safety screw.
5. Connect the Mesh Router to the battery.
6. Switch on the Mesh Router.

# Mesh Router User's Guide

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## Year Of Manufacture

To identify the year of manufacture, refer to the serial number of the instrument.

The letter in the serial number indicates the year of manufacture. For example, “M” indicates the manufacturing year is 2010.

Letter	Year
J	2008
K	2009
M	2010
N	2011
P	2012
Q	2013
R	2014
S	2015
T	2016
U	2017
V	2018
W	2019



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